Appendix E

Air Quality Analysis Report Summary

M-15 DEIS
Air Quality Analysis Report Summary

The Air Quality Analysis Report, provided under separate cover, is a companion document to the Draft Environmental Impact Statement (DEIS) for the M-15 project between I-75 and I-69 in Oakland and Genesee Counties.

In accordance with Michigan Department of Transportation (MDOT), Federal Highway Administration (FHWA), and U.S EPA procedures, this is a microscale analysis of carbon monoxide (CO) concentrations. The criterion for adverse impact is an exceedance of the National Ambient Air Quality Standards (NAAQS) (Table E-1) for CO at a sensitive receptor modeled for the year of opening (2010) and design year (2025).

Based on an examination of traffic counts in the corridor at all major intersections and projections of future traffic volumes, a worst-case intersection was identified for air quality analysis. The intent is to identify the intersection with the highest volumes and a potentially sensitive receptor on one corner. That intersection is Deer Ridge Road and M-15. Deer Ridge Road approaches M-15 from the east. Hubbard Road is its complement on the west of M-15. On the southeast corner is a home. This home is considered the sensitive receptor.

The prediction of future CO concentrations requires the input of geometric and traffic data into a software program developed jointly by EPA and FHWA. This program, called CAL3QHC includes elements of a line source dispersion model that estimates CO concentrations and elements of capacity analysis from the Highway Capacity Manual, the standard text for determining volume-to-capacity relationships and the resultant delay at an intersection's signals. The model considers through vehicle movements at speed, and idling vehicles that stop for the signal, then combines the concentrations from the two conditions. Emission rates for vehicles operating at various speeds and at idle (grams of CO per mile traveled or per minute of idling) are drawn from a separate EPA-sponsored model called MOBILE, in this case version MOBILE5a.

Input assumptions for the CAL3QHC model were as follows: Stability Class 4 (D); Wind Speed of 1 meter/second, with a wind search at 10 degree increments around a full 360 degrees; Minimum Temperature (an input to MOBILE5a) of 19 degrees Fahrenheit; background CO level of 2 parts per million; and a travel speed for through movements of 35 miles per hour.

The results of the CAL3QHC analysis follow this text, including its graphical output. The worst-case one-hour CO concentration in 2010, the year of opening, is estimated to be 3.3 parts per million (ppm), well below the NAAQS of 35 ppm. Converting to an eight-hour value using a persistency of 0.6 results in an eight-hour forecast of 2.8 ppm compared to the standard of 9 ppm. One- and eight-hour concentrations in 2025 are estimated to be 3.2 and 2.7 ppm, respectively. This project should have a positive impact on air quality by reducing congestion.

Future no-action conditions would be essentially the same as those with the project, as the right-of-way and lane positions in this roadway section will not change in any appreciable way. M-15 is in a five-lane section in this area, and would remain so. To compare future conditions with present conditions, CAL3QHC was run for 2000. The combination of lower traffic volumes and higher emission factors resulted in concentrations in 2000 that match those of 2010, 3.3 ppm for one hour and 2.8 ppm for eight hours.

Table E-1

National Ambient Air Quality Standards

POLLUTANT	STANDARD VALUE		STANDARD TYPE
Carbon Monoxide (CO)			
8-hour Average	9 ppm	(10 mg/m^3)**	Primary
1-hour Average	35 ppm	(40 mg/m^3)**	Primary
Nitrogen Dioxide (NO_2)			
Annual Arithmetic Mean	0.053 ppm	(100 $\mu g/m^3$)**	Primary & Secondary
Ozone (O_3)			
1-hour Average*	0.12 ppm	(235 $\mu g/m^3$)**	Primary & Secondary
8-hour Average	0.08 ppm	(157 $\mu g/m^3$)**	Primary & Secondary
Lead (Pb)			
Quarterly Average		1.5 $\mu g/m^3$	Primary & Secondary
Particulate < 10 micrometers (PM-10)			
Annual Arithmetic Mean		50 $\mu g/m^3$	Primary & Secondary
24-hour Average		150 $\mu g/m^3$	Primary & Secondary
Particulate < 2.5 micrometers (PM-2.5)			
Annual Arithmetic Mean		15 $\mu g/m^3$	Primary & Secondary
24-hour Average		65 $\mu g/m^3$	Primary & Secondary
Sulfur Dioxide (SO_2)			
Annual Arithmetic Mean	0.03 ppm	(80 $\mu g/m^3$)**	Primary
24-hour Average	0.14 ppm	(365 $\mu g/m^3$)**	Primary
3-hour Average	0.50 ppm	(1300 $\mu g/m^3$)**	Secondary

* The ozone 1-hour standard applies only to areas that were designated nonattainment when the ozone 8-hour standard was adopted in July 1997. This does not include the Detroit area. This provision allows a smooth, legal, and practical transition to the 8-hour standard.

** Parenthetical value is an approximately equivalent concentration.

1 CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0, JANUARY 1992

JOB: M-15 2025 SE Corner M-15 and Deer Ridge RUN: M-15 @ Deer Ridge, SE Corner 2010

SITE & METEOROLOGICAL VARIABLES

VS = .0 CM/S VD = .0 CM/S Z0 = 100. CM
U = 1.0 M/S CLAS = 4 (D) ATIM = 60. MINUTES MIXH = 1000. M AMB = 2.0 PPM

LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	LENGTH (M)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (M)	W (M)	V/C	QUEUE (VEH)
1. M-15 NB Approach	80.8	18.3	690.4	18.3	610.	90.	AG	1703.	13.7	.0	13.4		
2. M-15 NB Queue	86.9	18.3	145.6	18.3	59.	90.	AG	783.	100.0	.0	3.7	.87	9.8
3. M-15 NB Queue Left	6.1	12.2	16.9	12.2	11.	90.	AG	1050.	100.0	.0	3.7	.83	1.8
4. M-15 NB Depart	80.8	18.3	-570.0	18.3	651.	270.	AG	1673.	13.7	.0	13.4		
5. M15 SB Approach	-609.6	.0	.0	.0	610.	90.	AG	697.	13.7	.0	13.4		
6. M-15 SB Queue	-9.1	.0	-32.4	.0	23.	270.	AG	783.	100.0	.0	3.7	.35	3.9
7. M-15 SB Queue Left	67.1	6.1	64.3	6.1	3.	270.	AG	1050.	100.0	.0	3.7	.28	.5
8. M-15 SB Depart	.0	.0	609.6	.0	610.	90.	AG	781.	13.7	.0	13.4		
9. Hubbard EB Approach	.0	.0	.0	-609.6	610.	180.	AG	63.	20.0	.0	9.8		
10. Hubbard EB Queue	.0	-12.2	.0	-21.6	9.	180.	AG	1021.	100.0	.0	3.7	.50	1.6
11. Hubbard EB Queue Le	-3.0	-12.2	-3.0	-14.0	2.	180.	AG	1021.	100.0	.0	3.7	.09	.3
12. Deer Ridge Approach	69.2	18.3	69.2	640.1	622.	360.	AG	94.	20.0	.0	9.8		
13. Deer Ridge Queue	69.2	18.3	69.2	23.6	5.	360.	AG	1021.	100.0	.0	3.7	.28	.9
14. Deer Ridge Queue Le	73.2	30.5	73.2	41.9	11.	360.	AG	1021.	100.0	.0	3.7	.60	1.9

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JOB: M-15 2025 SE Corner M-15 and Deer Ridge RUN: M-15 @ Deer Ridge, SE Corner 2010

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. M-15 NB Queue	120	41	4.0	1703	1600	427.00	2	3
3. M-15 NB Queue Left	120	110	4.0	44	1600	427.00	2	3
6. M-15 SB Queue	120	41	4.0	682	1600	427.00	2	2
7. M-15 SB Queue Left	120	110	4.0	15	1600	427.00	2	2
10. Hubbard EB Queue	120	107	3.0	53	1600	427.00	2	3
11. Hubbard EB Queue Le	120	107	3.0	10	1600	427.00	2	3
13. Deer Ridge Queue	120	107	3.0	30	1600	427.00	2	3
14. Deer Ridge Queue Le	120	107	3.0	64	1600	427.00	2	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. REC 1 SE Corner M-1	111.3	47.2	1.8

1

JOB: M-15 2025 SE Corner M-15 and Deer Ridge RUN: M-15 @ Deer Ridge, SE Corner 2010

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1
0.	2.0
10.	2.0
20.	2.0
30.	2.0
40.	2.0
50.	2.0
60.	2.0
70.	2.0
80.	2.1
90.	2.4
100.	2.5
110.	2.7
120.	2.7
130.	2.9
140.	3.1
150.	3.1
160.	3.1
170.	3.1
180.	3.1
190.	3.1
200.	3.1
210.	3.0
220.	3.0
230.	3.0
240.	3.2
250.	3.3
260.	3.0
270.	2.6
280.	2.2
290.	2.0
300.	2.0
310.	2.0
320.	2.0
330.	2.0
340.	2.0
350.	2.0
360.	2.0
MAX DEGR.	3.3 250

THE HIGHEST CONCENTRATION IS 3.30 PPM AT 250 DEGREES FROM REC1 .

1 CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0, JANUARY 1992 PAGE 1

JOB: M-15 2025 SE Corner M-15 and Deer Ridge RUN: M-15 @ Deer Ridge, SE Corner 2025

SITE & METEOROLOGICAL VARIABLES

VS = .0 CM/S VD = .0 CM/S Z0 = 108. CM
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10. Hubbard EB Queue	.0	-12.2	.0	-21.6	9.	180.	AG	945.	100.0	.0	3.7	.50	1.6
11. Hubbard EB Queue Le	-3.0	-12.2	-3.0	-14.0	2.	180.	AG	945.	100.0	.0	3.7	.09	.3
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14. Deer Ridge Queue Le	73.2	30.5	73.2	41.9	11.	360.	AG	945.	100.0	.0	3.7	.60	1.9

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1 PAGE 2

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1 PAGE 3

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20.	2.0
30.	2.0
40.	2.0
50.	2.0
60.	2.0
70.	2.0
80.	2.1
90.	2.4
100.	2.5
110.	2.5
120.	2.7
130.	2.9
140.	3.0
150.	3.1
160.	3.1
170.	3.1
180.	3.1
190.	3.1
200.	3.0
210.	2.9
220.	2.8
230.	2.8
240.	3.2
250.	3.2
260.	3.0
270.	2.6
280.	2.2
290.	2.0
300.	2.0
310.	2.0
320.	2.0
330.	2.0
340.	2.0
350.	2.0
360.	2.0
MAX	3.2
DEGR.	240

THE HIGHEST CONCENTRATION IS 3.20 PPM AT 240 DEGREES FROM REC1 .

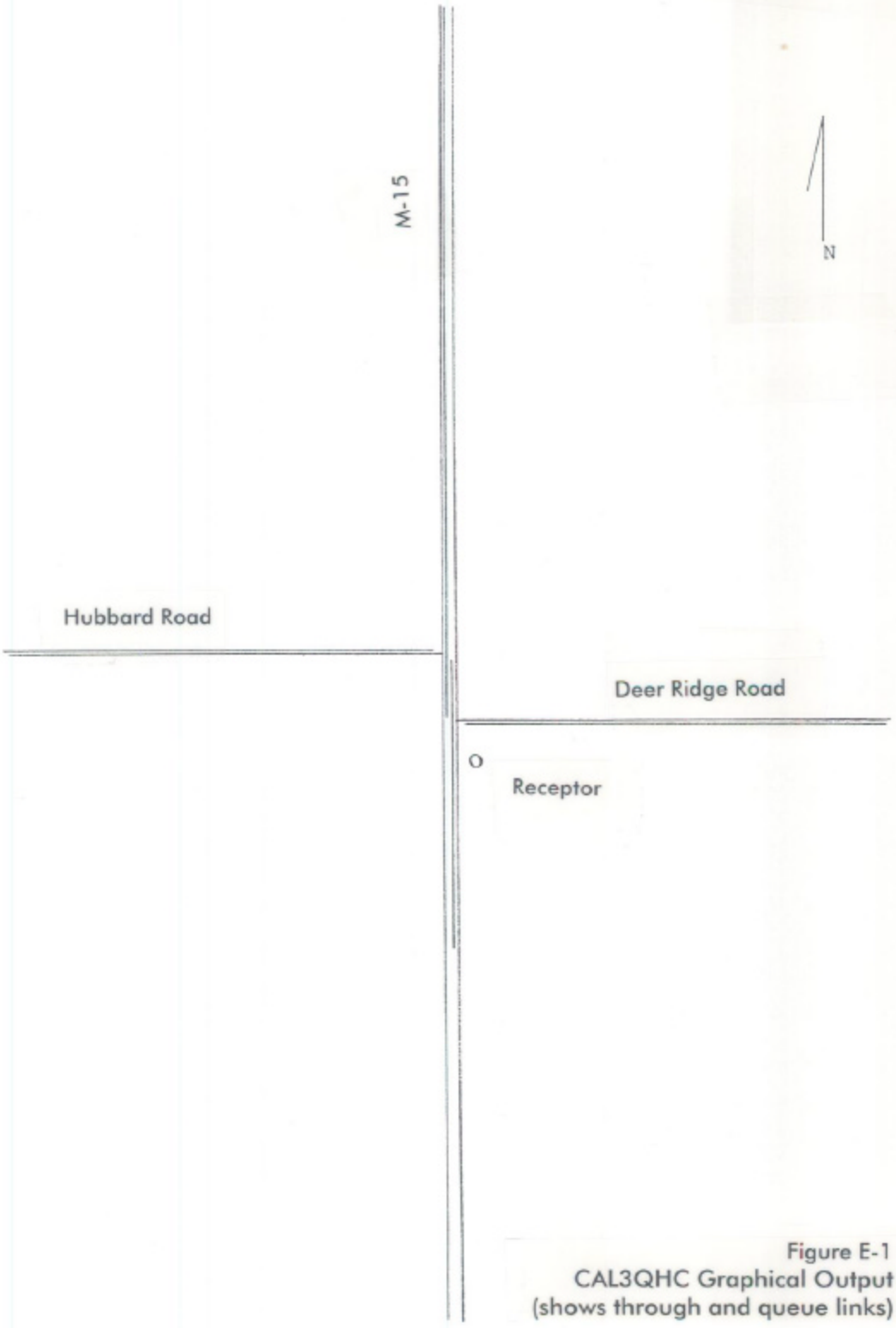

Figure E-1
CAL3QHC Graphical Output
(shows through and queue links)

Appendix F